Student Name: _____

Math 155 — Epidemiology — Prof. Kaplan

Review Questions

Problem 1

In 1970, the crude mortality rate (all causes) for Guyana (a developing country) was 6.8 per 1000 and for the United States it was 9.4 per 1000.

(a) Can the lower crude mortality rate in Guyana be explained by the fact that the United States has a larger population? Explain your answer. Answer comment:No.

The mortality rate adjusts for the size of the population.

(b) Give a probable explanation for the lower crude mortality rate in Guyana. Answer comment:Assuming that the lower rate in Guyana is not due to healthy living conditions or good medical care (which would seem unlikely in a developing country), a reasonable explanation is that the population of Guyana tends to be younger than that of the United States.

Problem 2

Crude and age-adjusted mortality rates (per 100,000 people) from "arteriosclerotic and degenerative heart diseases" are shown for Chile and the United States for 1967.

Country	Crude Rates	Age-Adjusted Rates
Chile	67.4	58.2
United States	316.3	131.4
Ratio: US/Chile	4.7	2.3

Which of the two rates is preferable for comparing the mortality rate from heart disease in the two countries? Why? Why do the ratios of the crude and age-adjusted rates for the two countries differ?

Problem 3

Assume that the prevalence of coronary heart disease decreases after age 70, but its incidence continues to increase with age. What is the most probable explanation for the divergence of these rates?

Problem 4

Two thousand women aged 55 years were given a health check and 100 were found to have high blood pressure. Ten years later all 2000 women attended a second check and another 300 women had developed high blood pressure.

(a) What was the prevalence of high blood pressure in the women (i) at age 55 and (ii) at age 65?

(b) How many women were "at risk" of developing high blood pressure at the start of the 10-year period?

(c) What was the incidence of high blood pressure in these women? Is this a measure of cumulative incidence or an incidence rate?

Assume that, on average, each of the 300 women who developed high blood pressure did so half-way through the ten year follow-up period.

(d) Calculate the total number of person-years at risk (of developing high blood pressure) during the 10 years.

(e) What was the incidence rate of high blood pressure in these women?

Problem 5

Four rats in one cage were found dead at a university animal colony. In the adjacent cage, one rat convulsed and died, two rats became ill but survived, and one rat was ill. The veterinarian declared that an epizootic was present (epizootic — epidemic in animals).

Which type of study was this:

[**a**] Uncontrolled observation
[B] Cross-sectional or prevalence study
[C] Experiment
[D] Cohort Study
[E] Case-control study

Problem 6

The study hypothesis is that alcoholics have an increased incidence of fatal automobile accidents. Design a case-control study to test this hypothesis using the following headings:

(a) Diagnosis of cases — difficult or not? Where would you find cases?

(b) Name a suitable population from which to choose controls.

(c) List matching characteristics for controls.

(d) What essential characteristic must you determine for each study member, and what difficulties might be encountered in determining this characteristic?

Problem 7

The likelihood of a pathogen or agent being transmitted from one infected person to another susceptible person is referred to as which of the following?

invasiveness variability virulence ***communicability***

Problem 8

Which of the following terms refers to a persistent, expected level of disease in a defined population?

epidemic outbreak ***endemic*** pandemic

Problem 9

Serial surveys involve which of the following?

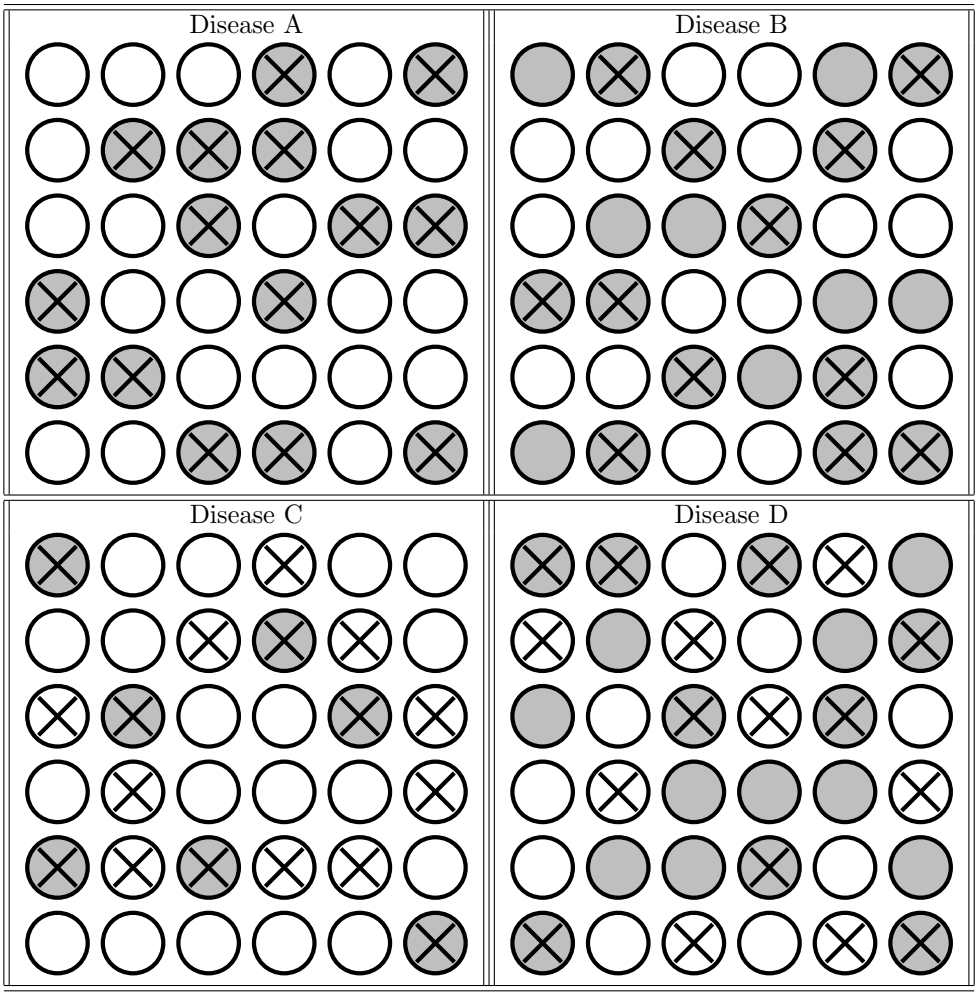
[A] Ecologic data
[B] Cross-sectional data
[C] Case-control data
[**d**] Cohort data

Problem 10

The diagrams below show 4 different diseases — A, B, C, D — along with exposure to some hypothesized cause. For each of the 4 diseases, say whether the exposure is necessary and/or sufficient.

Key:

- Exposed but not sick 
- Sick 
- Exposed and Sick 
- Neither exposed nor sick 



- Disease A
  - [A] Necessary but not sufficient
  - [B] Sufficient but not necessary
  - [**c**] Necessary and Sufficient
  - [D] Neither necessary nor sufficient
- Disease B
  - [A] Necessary but not sufficient
  - [**b**] Sufficient but not necessary
  - [C] Necessary and Sufficient
  - [D] Neither necessary nor sufficient
- Disease C
  - [**a**] Necessary but not sufficient
  - [B] Sufficient but not necessary
  - [C] Necessary and Sufficient
  - [D] Neither necessary nor sufficient
- Disease D
  - [A] Necessary but not sufficient
  - [B] Sufficient but not necessary
  - [C] Necessary and Sufficient
  - [**d**] Neither necessary nor sufficient

Problem 11

Match the following as a **descriptive** or an **analytic** epidemiological study.

- Who ***descriptive*** analytic
- Why descriptive ***analytic***
- How descriptive ***analytic***
- What ***descriptive*** analytic
- When ***descriptive*** analytic
- Where ***descriptive*** analytic

Problem 12

The outbreak of an illness among football players and coaches is hypothesized to be associated with a person's location — the north versus the south wing — in an athletic training center. Each player and coach was asked where he was practicing, resulting in the following 2×2 table.

	Illness	
Location	Yes	No
South	25	13
North	5	15

Use an appropriate measure to calculate the association between location and illness.

1.2 ***2.6*** 3.0 4.9 5.0

Problem 13

Suppose you wanted to monitor the trend in age-adjusted incidence rates of breast cancer over the calendar years 1980 through 2000. Which of the following standard populations is the most appropriate for adjusting the rates throughout this period?

A 1980
B 1990
C 2000
d It does not matter.

Problem 14

In Los Angeles, public health authorities identified 100 people with disease X. These cases came from 40 affected households with 230 people. Assuming that each household had only one primary case and that each primary case attended a local daycare center, what is the secondary attack rate?

A 32%
B 17%
C 43%
d 67%

Problem 15

Which of the following best defines external validity?

A The component of accuracy reflecting the level of systematic error in the study
b The extent to which the results of a study are relevant to people who are not part of the study
C The extent to which the results of the study are not attributable to bias or confounding
D Two of the above describe external validity.

Problem 16

Why is a randomized, blinded experimental study best for establishing cause-effect relationships?

A Randomization balances out the effects of confounding factors.
B The study design establishes a time sequence of events.
C Blinding can minimize bias.
d All of the above.

Problem 17

Answer these true-or-false questions.

1. Cancer screening is a form of primary prevention. True ***False***
2. The ecologic study design is a useful approach for measuring the association between exposure and disease at the individual level. True ***False***
3. Incidence is a better measure of disease risk than prevalence. True ***False***
4. If the disease is common, the odds ratio will approximately equal the risk ratio. True ***False***
5. In a case-control study, the ratio of cases to controls should always be 1:1. True ***False***

Problem 18

A screening test for a newly discovered disease is being evaluated. In order to determine the effectiveness of the new test, it was administered to 900 workers.

150 of the individuals diagnosed with the disease tested positive. A negative test finding occurred in 60 people who had the disease. A total of 50 persons not diseased tested positive for it.

(a) Draw the appropriate 2×2 table to represent the above information. Double check it to make sure that you have it right.

For each of the following, choose the best answer. You may also want to show your answer in terms of the numbers you entered in the table, for example in the form 60/150.

(b) What is the prevalence of disease cases in the population?

- [A] 77%
- [B] 75%
- [C] 9%
- [D] 23%
- [**e**] Can't be determined from the information given.

(c) What is the sensitivity of the test?

- [**a**] 71.4%
- [B] 74.0%
- [C] 92.8%
- [D] 23.3%

(d) What is the specificity of the test?

- [A] 46.9%
- [B] 89.3%
- [**c**] 92.8%
- [D] 27.8%

(e) What is the overall accuracy of the test?

- [A] 71%
- [B] 75%
- [C] 78%
- [**d**] 88%

(f) What is the predictive value of a positive test? (Positive predictive value.)

- [A] 53.8%
- [B] 71.1%
- [C] 78.8%
- [**d**] 75.0%

(g) What is the predictive value of a negative test? (Negative predictive value.)

- [A] 76.7%
- [B] 88.8%
- [**c**] 91.4%
- [D] 92.8%

(h) Say whether "accuracy" is a good measure of the effectiveness of a diagnostic test. Explain why or why not.

Problem 19

Should screening for mammograms for women under 50 be de-listed from insurance? Write two paragraphs, one arguing for and one arguing against. I'm not looking for advocacy, just a fair account of the arguments for and against. [Take 10 minutes.]

Problem 20

Describe the basic means of surveillance commonly used in public health. Explain how these support or fail to support surveillance of the outbreak of H1N1. [10 minutes]

Problem 21

Write a short answer to each of the following. (You might want to cut-and-paste the list, so that you fill in your answer underneath the corresponding item.)

(a) What is a confounder? What problems or opportunities does confounding produce? Describe some strategies for dealing with the problems or for exploiting the opportunities.

(b) What is the difference between relative and absolute risk. Which is more informative in what situations?

(c) Given an example of a setting in which it would be appropriate to calculate an odds ratio. (You can make up the example, but make it plausible.) Create a table in the standard format that gives an odds ratio of 3. You can make up the numbers any way you want.

(d) Compare and contrast cohort and case-control studies? In what circumstances is a case-control study most appropriate?

(e) What is an "epidemic curve?" Describe how the epidemic curves for a point source and a propagative epidemic differ?

Problem 22

Here is part of an op-ed essay in the New York *Times*: Nicholas Kristof, "Cancer from the kitchen?" Dec. 5, 2009. Read it, then answer the question posed at the bottom.

> This last week I attended a fascinating symposium at Mount Sinai School of Medicine in New York, exploring whether certain common chemicals are linked to breast cancer and other ailments.
>
> Dr. Philip Landrigan, the chairman of the department of preventive medicine at Mount Sinai, said that the risk that a 50-year-old white woman will develop breast cancer has soared to 12 percent today, from 1 percent in 1975. (Some of that is probably a result of better detection.) Younger people also seem to be developing breast cancer: This year a 10-year-old in California, Hannah, is fighting breast cancer and recording her struggle on a blog.
>
> Likewise, asthma rates have tripled over the last 25 years, Dr. Landrigan said. Childhood leukemia is increasing by 1 percent per year. Obesity has surged. One factor may be lifestyle changes — like less physical exercise and more stress and fast food — but some chemicals may also play a role.
>
> Take breast cancer. One puzzle has been that most women living in Asia have low rates of breast cancer, but ethnic Asian women born and raised in the United States don't enjoy that benefit. At the symposium, Dr. Alisan Goldfarb, a surgeon

specializing in breast cancer, pointed to a chart showing breast cancer rates by ethnicity.

"If an Asian woman moves to New York, her daughters will be in this column," she said, pointing to "whites." "It is something to do with the environment."

What's happening? One theory starts with the well-known fact that women with more lifetime menstrual cycles are at greater risk for breast cancer, because they're exposed to more estrogen. For example, a woman who began menstruating before 12 has a 30 percent greater risk of breast cancer than one who began at 15 or later.

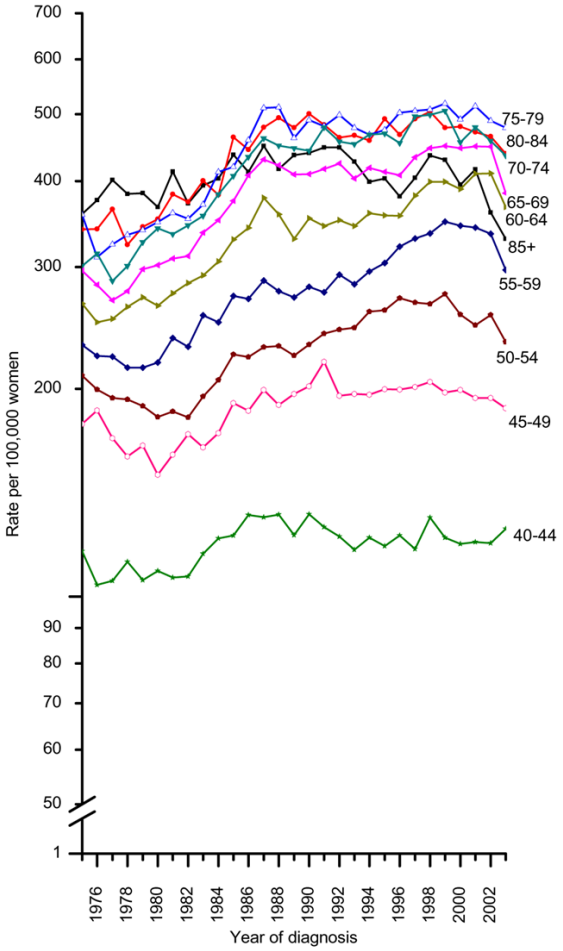
It's also well established that Western women are beginning puberty earlier, and going through menopause later. Dr. Maida Galvez, a pediatrician who runs Mount Sinai's pediatric environmental health specialty unit, told the symposium that American girls in the year 1800 had their first period, on average, at about age 17. By 1900 that had dropped to 14. Now it is 12.

A number of studies, mostly in animals, have linked early puberty to exposure to pesticides, P.C.B.'s and other chemicals. One class of chemicals that creates concern — although the evidence is not definitive — is endocrine disruptors, which are often similar to estrogen and may fool the body into setting off hormonal changes. This used to be a fringe theory, but it is now being treated with great seriousness by the Endocrine Society, the professional association of hormone specialists in the United States.

These endocrine disruptors are found in everything from certain plastics to various cosmetics. "There's a ton of stuff around that has estrogenic material in it," Dr. Goldfarb said. "There's makeup that you rub into your skin for a youthful appearance that is really estrogen."

Your boss has asked you to do a quick evaluation of the increase from 1 percent to 12 percent cited in the essay.

In doing some background research, you find the following graph of age-specific **invasive** breast cancer incidence rates among women 40 years old and above, from 1975 to 2003. (Source: Jemal *et al.* (2007) *Breast Cancer Research* **9**:R28.)



Also, with an Internet search you find that mammography started to become available in the mid 1970s, and that the current age-adjusted incidence rate for white women is 126 per 100,000 women per year, while the death rate is 23.4 per 100,000 per year.

- Using this information, **as well as any other knowledge you have that bears on the issue**, outline in one or two paragraphs what factors other than "common chemicals" might account for the dramatic increase in breast cancer rates cited in the article.
- Describe in one or two paragraphs a reasonable design for a study to investigate the possible link between "common chemicals" and breast cancer. Assume that you would need to have the study results in one or two years. If there are serious fundamental obstacles to designing a reasonable study, say what they are. (By "fundamental" obstacles, I do **not** mean problems with getting funding or getting access to existing data.)

Problem 23

Kenneth Rothman developed a causal model in which the factors contributing to a given health-related state or event are represented by pieces of a pie, with the entire pie making up a sufficient cause for the health outcome. The health-related state or event may have more than one sufficient cause, with each sufficient cause consisting of multiple contributing factors that are called component causes (represented by the

pieces of the pie). For example, component causes A, B, and C may be sufficient to cause a disease, but component causes A, D, and E may also be sufficient to cause the disease. In this case, A is necessary because it is required in each of the sufficient causes. Choose **one** of the following conditions and draw the Rothman "pies" for the condition. (You don't have to give an absolutely complete list of component causes, just enough to show that you have a good understanding of the condition and some of the causal components.)

Conditions: Lung cancer, Cervical cancer, Obesity, Diabetes

Problem 24

Which study design is best suite for establishing temporality?

- [A] Case-Control
- [B] Cross-Sectional
- [**c**] Prospective Cohort
- [D] Retrospective Cohort

Problem 25

Cohort studies are prone to bias because of selection. Explain how the healthy-worker effect is a type of selection bias.

Problem 26

Which of the following best defines confounding?

- [A] An association may appear to exist merely because of the luck of the draw.
- [B] Confounding is directly influenced by sample size.
- [C] Deviation of the results from the truth.
- [**d**] A bias that results when a third factor is associated with the outcome and, independent of that association, is associated with the exposure.
- [E] Reversal of cause and effect.

Problem 27

In a cohort study, a group of boys aged 8-15 years who were arrested because of substance abuse and identified as chemically dependent, were followed for 15 years. These boys were also classified according to whether they had a history of sexual abuse. Of interest was whether a history of sexual abuse was significantly associated with suicide attempt in these chemically dependent boys, the data for which are presented in the table:

History of	Suicide Attempt	
Sexual Abuse	Yes	No
Yes	11	34
No	29	224

(a) What is the risk of suicide attempt for the chemically dependent boys with a history of sexual abuse?

- [**a**] $11/45 = 244$ per thousand
- [B] $11/34 = 323$ per thousand
- [C] $29/253 = 115$ per thousand
- [D] $29/224 = 129$ per thousand
- [E] $30/258 = 116$ per thousand

(b) What is the risk of suicide attempt for the chemically dependent boys without a history of sexual abuse?

- [A] $11/45 = 244$ per thousand
- [B] $11/34 = 323$ per thousand
- [**c**] $29/253 = 115$ per thousand
- [D] $29/224 = 129$ per thousand
- [E] $30/258 = 116$ per thousand

(c) What is the risk ratio?

- [A] $323/129$
- [**b**] $244/115$
- [C] $115/129$
- [D] $11 \cdot 224/29 \cdot 34$

(d) Suppose eight boys with a history of sexual abuse were lost to follow-up and therefore not reported in the table. In analyzing the situation, you estimate risk ratios for two extreme hypothetical scenarios, one in which all the missing boys attempted suicide, and the other in which none of the missing boys attempted suicide. You get two confidence intervals on the risk ratio:

(i) 1.90 to 5.14

(ii) 0.97 to 3.39.

Which hypothetical scenario does confidence interval (i) correspond to:

- [**a**] All the missing boys committed suicide.
- [B] None of the missing boys committed suicide.
- [C] No way to know.

Problem 28

A cohort study involving Swedish females born between 1952 and 1989 assessed the association between eating disorders and parental education. From the results of this study presented in the table, calculate an appropriate measure to indicate whether a relationship exists between mother's education and the daughter's risk of having an eating disorder and present your conclusion.

Mother's Education	Number	Percent	Number of Events	Person-Years at Risk
Elementary	2791	21.3	10	42592
Secondary	6365	48.5	21	80468
Post-secondary	3968	30.2	22	43358

Problem 29

A trial is likely to be underpowered, biased, or misleading if which of the following occurs:

[A] A large number of participants is lost to follow up.
[B] A substantial number of participants do not adhere to the study intervention.
[C] Baseline variables are not balanced between intervention groups.
[D] All of the above lead to these problems.

Problem 30

Match the descriptions with the types of screening test results:

A. True positive

B. False positive

C. False negative

D. True negative

E. Sensitivity

F. Specificity

(a) Proportion of people with the disease who have a positive test A B C D ***E*** F

(b) May cause unnecessary stress, anxiety, and treatment A ***B*** C D E F

(c) May cause a false sense of security A B ***C*** D E F

(d) Proportion of people without the disease who have a negative test A B C D E ***F***

(e) Correctly identifies people as having the disease when, in fact, they do ***A*** B C D E F

(f) The preferred situation for a subject to be in A B C ***D*** E F

Problem 31

Match the definitions with the terms:

A. Prior probability

B. Positive predictive value

C. Negative predictive value

(a) The probability that a person who has a negative test does not have the disease A B ***C*** none

(b) The probability that a person who does not have the disease has a negative test A B C ***none***

(c) The probability that an individual with the disease has a positive test A B C ***none***

(d) The probability that an individual with a positive test actually has the disease A ***B*** C none

(e) Prevalence of disease in a specified population ***A*** B C none

Problem 32

Screening for disease involves which type of prevention?

[A] Primary
[**b**] Secondary
[C] Tertiary

Explain your answer briefly: